1 n. Rynmann's Wetterbuchlein. Table of contents, edition of 1510, Munich.
1 n. Bauern Praktik. Munich, 1512.
1 n. Die Bauern Praktik. Edition of 1508, first page.
1 n. Practica auf das Jahr 1502.
1 Famine areas in India.
3 n. Baltimore weather, 1871–1902; May 1, September 12 and December 25.
1 n. Baltimore rainfall. Daily frequency, 1871–1900.
1. Diurnal temperature curve for Baltimore for the year.
1. Kite flight at Blue Hill Observatory.
1 n. Cyclone prognostics. Abercromby.
1 n. Typical storm at sea, North Atlantic Ocean.
4 n. Storm tracks for February, April, July, and October, in the United States, ten years.
4 n. Cold wave, February 11, 12, 13, and 14, 1899.
1 n. Typical high area, fair weather, September 14, 1902.
1 n. Type of fair weather, February 20, 1903.

METEOROLOGICAL OBSERVATIONS OBTAINED BY THE USE OF KITES OFF THE WEST COAST OF SCOTLAND, 1902.

By W. N. SHAW, Sc. D., F. R. S., and W. H. DINES, B. A. Read before the Royal Society, London, May 14, 1903.

ABSTRACT FURNISHED FOR THE MONTHLY WEATHER REVIEW.

This paper presents the results of the first organized attempt to obtain a series of automatic records of temperature and humidity in the upper air of the British Isles or neighboring seas by means of kites. They are derived from the records of forty kite ascents in which instruments were raised, and which were carried out by Mr. Dines and his two sons, under the auspices of the Royal Meteorological Society in cooperation with a committee of the British Association, during the months of July and August, 1902. Two of the ascents were from a small island in Crinan Bay, Argyllshire, the remainder from the deck of a tug steaming in the Jura Sound or neighboring sea. Kites were raised on seventy-one occasions, but, on thirty-one of them, the force of the wind, even when assisted by the speed of the tug at seven knots, was not sufficient to raise the recording instruments. On those occasions an experimental form of registering air thermometer alone was carried. The average recorded height of ascents with instruments was 5900 feet (1940 meters), and average estimated height of the seventy-one ascents 4200 feet (1400 meters); a height of 12,000 feet (3700 meters) was passed on two occasions and 15,000 feet (4500 meters) was reached once, but the record was lost owing to the breaking away of the highest kite.

The kites and winding gear were designed and constructed by Mr. Dines. Particulars as to them are given in the Quarterly Journal of the Royal Meteorological Society, vol. 29, p. 69, 1903.

The greatest angular elevation given by the kites with a short length of line was 62° 31′; the greatest height reached with one kite was 5500 feet (1700 meters), with two 9200 feet (2800 meters), with three 12,400 feet (3800 meters).

The method of dealing with the records is described and illustrated. The results are expressed on a diagram representing, by a series of points and connecting lines, the height in the air of a series of temperatures at successive intervals of 1° C. for each ascent. The diagram thus presents a series of isothermal lines referred to time and height as coordinates. So far as the observations extend, the changes in the actual and relative positions of the lines show how the temperature varied at the surface and in the upper air during the period of the experiments.

On account of the unsatisfactory nature of the hygrometric records only four stages of humidity are dealt with, and these are entered upon the diagram upon which are also recorded the observed heights of clouds entered by the kites, the direction of the wind at the surface and in the upper air, and particulars of the weather.

For the purpose of comparison the curves of variation of the barometer at Fort William and Ben Nevis, during the period of the experiments, are plotted on the same diagram, and certain particulars are also given about the temperatures of the wet and dry bulb at those stations.

From the diagram the fall of temperature for each 500 meters of each ascent is taken out and tabulated. The table gives the following average results:

Table of fall of temperature, in degrees centigrade, for each 500 meters of ascent.

Meters.	July.		August.	
	Ascents.	° C.	Ascents.	° C.
0 to 500	22	3.0	13	2.6
500 to 1,000	16	2.8	11	2.8
1,000 to 1,500	9	2.2	9	2.3
1,500 to 2,000	2	2.0	7	2.1
2,000 to 2,500	1	2.0	3	2.0
2,500 to 3,000	.....	.....	2	2.0
3,000 to 3,500	.....	.....	2	1.7

The range of fall for the first 500 meters varied from 4° C. to 1° C. The smallest fall was associated with an inversion of temperature gradient not far from the surface. An inversion of temperature gradient with very dry air above a layer of clouds was shown also on one of the occasions of steepest gradient near the surface. The steep gradients observed in the lower strata are shown to be associated with anticyclonic conditions preceding the approach of a depression, and by examples on five occasions it is shown that the characteristic of the passage of a depression is that the isothermal lines of the diagram open out as the depression comes on, the average diminution of gradient for the change of barometric conditions amounting to as much as 50 per cent.

The paths of the centers of depressions producing these changes are shown on the maps taken from the monthly weather reports of the meteorological office. It appears that they passed the station on all sides at various distances, but none actually crossed it. The results show that whatever was the path taken by the center the column of air over Crinan became relatively much more nearly uniform in temperature under the influence of the depression, and therefore probably represented a relatively warm column of air.

The average of the values of temperature gradients in columns of air of different heights derived from all the Crinan ascents are as follows:

Height of column. Meters.	Temperature gradient. Per 100 meters.
500	0.56
1000	0.56
1500	0.52
2000	0.50
2500	0.48
3000	0.46
3500	0.43

It must be remembered that a moderately strong wind was required for the higher ascents, and they therefore refer to a more or less special type of weather. The gradients for the higher columns are accordingly not so generally applicable as those for the lower columns.

The results are compared with temperature gradients observed elsewhere as given in Hann's Meteorologie, with the theoretical temperature gradient in dry air (1° C. per 100 meters), and with that for saturated air having an initial temperature of 12° C. The last differs but little from 0.53° C. per 100 meters for all ranges up to 2000 meters and then increases. The average Crinan gradient is almost identical with this and with the conventional correction in use in this country [England] for the reduction of temperatures to a common level, viz, 1° F. per 300 feet.

The last part of the paper is devoted to considering the differences between the temperatures as observed in the free air at the same height as the summit of Ben Nevis and those read on the mountain itself. The differences are always in favor of the free air which is shown to be on the average 2.6°

warmer than the mountain summit. Various circumstances are adduced to support the result, and the explanation is sought in the suggestion that the air flowing from the sea over the mountain would be mechanically raised and practically subject to the adiabatic gradient which is not reached in the free air. The consideration of the relative heights of clouds as observed on the hillsides and over the sea is adduced in corroboration.

A CURIOUS COINCIDENCE. IS IT ACCIDENTAL OR GOVERNED BY LAW?

By Mr. G. N. SALISBURY, Section Director, Seattle, Wash.

Two or three years ago the writer noticed in the annual precipitation totals of the Seattle station a certain apparent recurrence or periodicity in groups or series of three, and looked forward with much interest to see whether it would longer continue. It was found that the light rainfall of 1901 filled the conditions of the recurrence, and the writer concluded that, in accordance with the series, the year 1902, as a whole, should be one of maximum precipitation. Therefore, even during the long dry spell of last summer and autumn, he never lost confidence that the deficiency in precipitation would be made up. That the confidence was justified was seen in the heavy rainfall of November and December, while the total precipitation for 1902 was 45.78 inches, the greatest amount since the beginning of the rainfall record at Seattle.

To illustrate more clearly what is meant, the total annual rainfalls at Seattle are given in their order, beginning with 1892: *31.32*, 45.16, 41.08, *29.69*, 42.83, 41.53, *29.28*, 37.13, 36.43, *30.18*, 45.78. A striking peculiarity may at once be recognized in the above figures, viz: beginning with 1892, every third year appears to be one of minimum rainfall, thus: 1892, 31.32; 1895, 29.69; 1898, 29.28; 1901, 30.18. Also every third year beginning with 1893 appears to be a maximum, thus: 1893, 45.16; 1896, 42.83; 1899, 37.13; 1902, 45.78. Representing the minimum values by *c*, the maximum values by *a*, and the intermediate values by *b*, there results a recurring cycle or series like this: *c..a..b..c..a..b..c..a..b..c..a..* The records for 1890 and 1891 are incomplete, but judging from the record of Madrone, which is a near-by station, the year 1890 would be an *a* year and the year 1891 a *b* year, thus further extending the series.

Curiosity was naturally aroused to see if the same apparent 3-year cycle could be detected at other stations, and investigation revealed that at all stations throughout the State, so far as observations were complete, the same 3-year recurrence had obtained since 1890. As far as the investigation was pursued the same was found true in Oregon, Idaho, and extreme northern California.

This is certainly an interesting coincidence, if nothing more, and the question arises: "Is it an accidental one merely or is it one due to imperfectly understood cosmical causes, which may vary the track of precipitation-producing storms from year to year throughout a certain well-defined fluctuation, so that they return every third year to nearly the same position?"

Unless the records should show a similar recurrence extending back indefinitely we must conclude either (1) that the recurrence is wholly accidental or (2) that a new era has begun in the distribution of precipitation within recent years. In view of our well-established confidence in the constancy and permanence of natural phenomena, the latter conclusion is improbable. The former would be legitimate if there was sufficient past evidence, in the shape of records that could be relied upon. But unfortunately it is only within the past ten years that a considerable number of regular and reliable records of rainfall have been kept in this State. At only a few stations, viz: Spokane, Walla Walla, Vancouver, etc., does the record extend back as far as 1880. For the past twenty-five years at Madrone the third year has always been one of minimum precipitation; but previous to 1890, the order of recurrence of the three years is reversed every cycle, so that we have such a series as: *a..b..c..b..a..c..a..b..c..b..a..c..a..b..c*, etc.

That the annual rainfall should be arranged in a 3-year period in the order a..b..c..for twelve years over the whole State is a remarkable coincidence, even if accidental, but that the recurrence should continue for twenty-five years, or over eight complete 3-year cycles, even at a single station, suggests that there may be a pronounced physical cause. The writer does not insist that it is anything more than a single coincidence, being aware that meteorologists have long ago decided that such a thing as a regular cycle in precipitation need hardly be looked for. The coincidence, however, is so suggestive as to make one ardently wish that the rainfall records of Washington and other Northwestern States, prior to 1890, were not so few, irregular, or unreliable. It is also an incentive to the public spirited voluntary observer to continue his valuable records, showing, as it does, how important his records are as data in the solution of vital climatic problems.

A further interesting coincidence is the correlation of the annual mean barometer with the apparent rainfall cycles. During the past twelve years at the Weather Bureau stations of Washington, Oregon, and Idaho, viz: Seattle, Spokane, Walla Walla, Boise, Pocatello, Baker City, Portland, and Roseburg, the third year of minimum rainfall has invariably coincided with a year of maximum annual mean barometer. The years of maximum rainfall have also coincided with years of minimum mean barometric pressure. A coincidence of maximum rainfall with low barometer and of minimum rainfall with high barometer, is in accordance with meteorological principles and might be naturally expected. But that it should continue throughout the calendar year, and also be in cycles of three, strengthens the suspicion that there may be something more than accident in the coincidence.

CLIMATOLOGY OF COSTA RICA.

Communicated by Mr. H. PITTIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—On the Pacific slope the drought continued up to the 8th, when the rain was general all over the country. The amount of rain for this month and also the duration of same have been without exception in excess over previous years. In San José temperature, pressure, and relative humidity have been about normal; rainfall, 371 millimeters against 230 millimeters, mean for 1889–1900; sunshine, 193 hours against 165 hours, with rather cloudy afternoons. On the Atlantic slope the rainfall was generally less than the normal.

Notes on earthquakes.—May 3, 3^h 36^m a. m., light shock E–W, intensity III, duration 10 seconds. May 14, 6^h 16^m a. m., very slight shock NW–SE., intensity II, duration 4 seconds. May 27, Tres Rios reports one strong shock followed by another, rather protracted, not felt in Jan José. May 28, 2^h 03^m a. m., rather strong shock E–W, intensity IV, duration 6 seconds, reported also from San Isidro Alajuela. May 29, 11^h 47^m p. m., light shock NW–SE, intensity II, duration 3 seconds.

ATMOSPHERIC ELECTRICITY CONSIDERED FROM THE STANDPOINT OF THE THEORY OF ELECTRONS.[1]

By Prof. HERMANN EBERT of the University at Munich.

Recent investigations into the composition of the air, which we already thought we knew so well, have revealed to us a number of new constituents among which the monatomic noble gases discovered by W. Ramsay, and more especially the so-called atmospheric ions or electrons of Elster and Geitel, appeal

[1] A lecture delivered before the eighty-fifth session of the Swiss Society of Natural Sciences, Geneva, 1902, and translated from the Meteorologische Zeitschrift, Bd. 20, 1903, pp. 107–114, by Dr. C. Abbe, Jr.